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EVOKED RESPONSE MEASURES OF RESOURCE ALLOCATION: EFFECTS OF PRI--ETC(U)
MAY 80 L F ELFNER, R R STANNY, W R HOWSE AFOSR-79-0097
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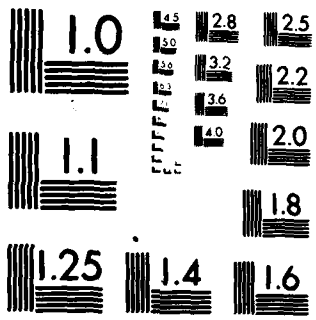

MICROCOPY RESOLUTION TEST CHART
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The major emphasis of the research was to assess the utility of employing event-related potentials in monitor type tasks. The "work manipulation" paradigm was employed. Auditory probes were presented along a secondary channel unrelated to the perceptual-motor task. In the initial study amplitude and latency measures of Wave V of the brain stem evoked potential were measured to auditory probes under conditions of tracking a visual target with a joystick, and just observing the visual display. It was noted that a reduction in amplitude and an increase in latency of Wave V occurred during the →

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tracking task. Although not statistically significant all subjects demonstrated the same effect.

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INTRODUCTION

That ERP is a useful measurement of higher-order functioning is "fait accompli." The level of the central nervous system that reflects higher-order functioning is in dispute. Oatman (1976) has demonstrated attentional effects at several levels in the auditory system of cat.

Since attentional diversion from auditory stimuli is a measure of import in assessing the effect of a visual primary task, we decided to observe the early potentials of the auditory evoked response to determine if a visual motor task would affect the neuronal processing of auditory stimuli at the level of the brainstem. An odd-ball uncertainty task (Sutton, 1965) was employed since the P_3 wave is very evident under this procedure. The visual task consisted of playing one of the commercial pong games on a TV screen.

It is hypothesized that the Wave V of the brainstem ERP will show a reduction in amplitude and a longer latency during a visual motor task than during a simple odd-ball procedure.

METHOD

SUBJECTS: Five undergraduate students volunteered to perform in the study. All exhibited normal hearing with no demonstrable central nervous system problems.

APPARATUS: A TV game (Radio Shack Model 603056) provided the perceptual-motor task. The game was projected on a Sony 19" video screen. The auditory signal (2000 Hz) was generated by a Hewlett-Packard (Model 200) audio oscillator and delivered to a set of TDH-39 earphones. A Grason-Stadler probability generator (Model 1284) randomized the presentation of the target stimuli. Intensity of the Auditory stimuli was controlled by a pair of (Tech Lab,

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Model 850) attenuators. Shaping (onset, off-set 2.5 msec) and duration (7.5 msec) of the signals and the ISI were controlled by Grason-Stadler (Model 829E) switches and (Model 471) timers. The ERP were averaged and hard copied on a Nicolet (Model 1074) averager and a Hewlett-Packard XY plotter. The recording electrode was at vertex, the reference electrode at right mastoid, a ground electrode at left mastoid. The EEG was filtered below 0.1 kHz and above 3.0 kHz and amplified by 10^6 through the use of cascaded preamplifiers (Grass P15, and Tektronix type 122).

PROCEDURE: Initially S was wired with the three electrodes. Impedance was kept below 5 k ohms. Then a short session of training to detect the 2dB softer target stimuli was employed. S then was given practice in playing the pong game until reasonably stable in terms of performance level.

Auditory stimuli were delivered at a repetition rate of 30 per sec. Detection of the softer rare-occurring stimulus (33dB SL) was reported with a button press. Each ERP represented a minimum of 4096 evoked presentations of the target stimulus.

RESULTS

The individual data are shown in figures 1, 2, 3. The upper trace shows the wave V ER elicited while playing the pong game. The second trace shows the wave V ER elicited while the subject detected auditory signals. Figure 3 shows

Insert Figs. 1, 2 & 3 about here

the above plus an evoked response when the subject was resting. (not instructed to listen to the low intensity signals with the video tube off.) A t-test performed on the mean latencies and amplitudes of Wave V failed to demonstrate statistical significance. However, all amplitudes were somewhat greater in the auditory alone condition when compared to the potentials evoked while playing the pong game.

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It is interesting to note in Figures 1 and 2, subjects 1 and 2, that during the auditory attention task a noticeable post-auricular response occured following Wave V.

DISCUSSION

Since Hernandez-Peon (1955) demonstrated the inhibition of auditory neural responses by visual distraction in cat, a great deal of effort has been expended in the area of intersensory attentional effects. As mentioned in the introduction the late components of ERP reflect cerebral activity and do exhibit selective attentional effects (Hilyard et al, 1973). However, little is known about the lower levels of the central nervous system, in terms of attentional effects. Lukas (1979) recently reported a reduction in amplitude of brain stem evoked response potentials both in the auditory nerve and the inferior colliculus response to auditory tonal bursts. This reduction was effected by introducing a visual letter display which the subject attended to. The procedure controlled for middle ear effects by using short duration high frequency stimuli. Lukas's results suggest that during concentrated attention to a visual stimuli, irrelevant auditory may be suppressed at a peripheral level possibly through the action of the olivocochlear bundle (Rasmussen, 1939).

The present data lend support to the concept that paying attention to a relevant visual motor task effects a reduction in amplitude (and a slight lengthening of the latency) of the evoked response to an irrelevant auditory stimulus. In the present study only the Wave V of the brainstem evoked response was studied. No attempt was made to evaluate the auditory nerve component. Nevertheless, it seems apparent that the inhibitory effect is present at least by the level of the inferior colliculus.

The results of the present study are very encouraging in terms of providing information concerning the "attentional" process in humans. The study of higher-order processing of information in humans has been hindered by the lack of a broadly applicable model. Understanding the underlying neural processes should provide the necessary information to formulate such a model.

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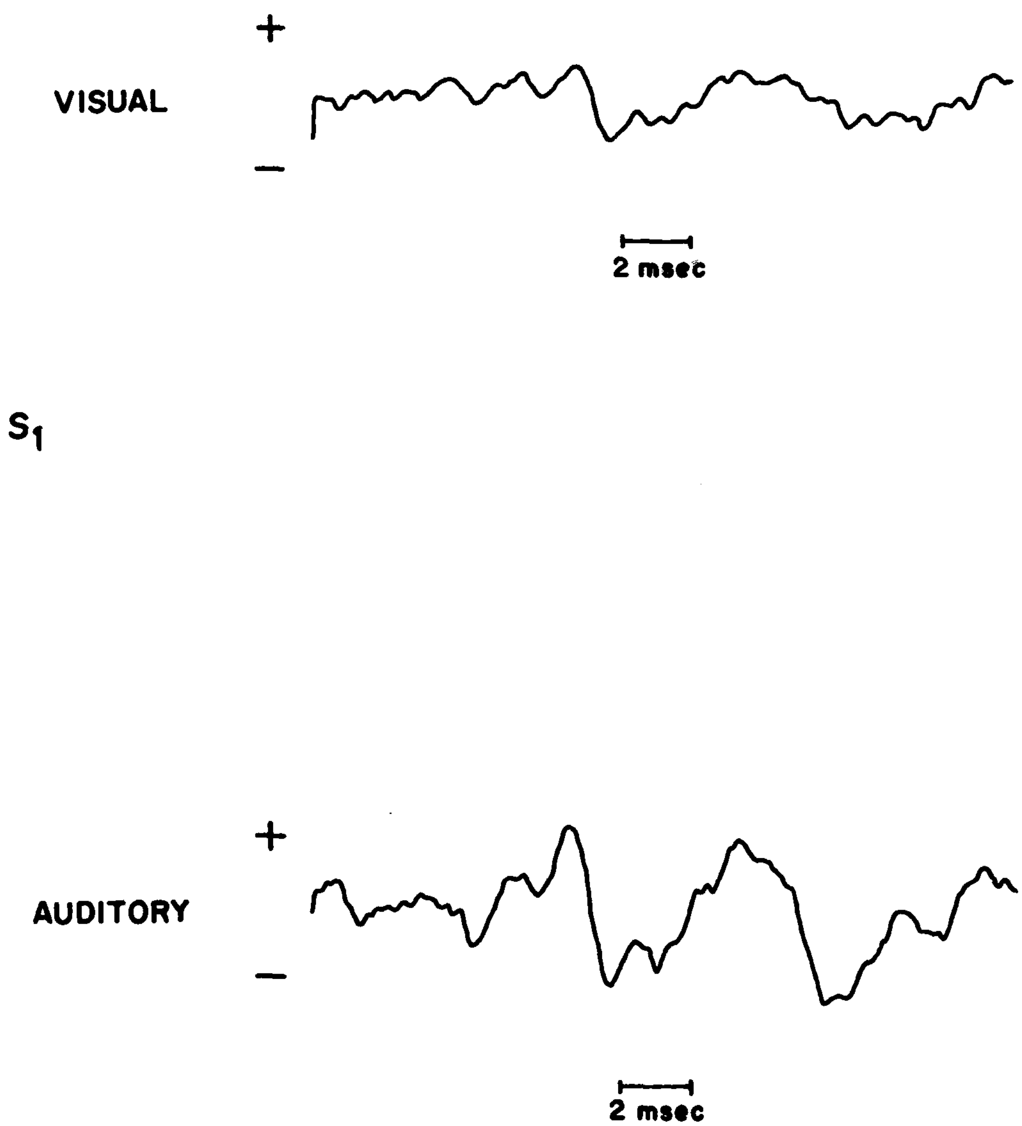
FIGURE CAPTIONS

Figure 1. Brainstem evoked response to an auditory stimulus average of 4096 target stimuli in an odd-ball task. For Subject 1.

Figure 2. Brainstem evoked response to an auditory stimulus average of 4096 target stimuli in an odd-ball task. For Subjects 2 and 3.

Figure 3. Brainstem evoked response to an auditory stimulus average of 4096 target stimuli in an odd-ball task. For Subjects 4 and 5. The lower evoked potential is during a rest only control condition.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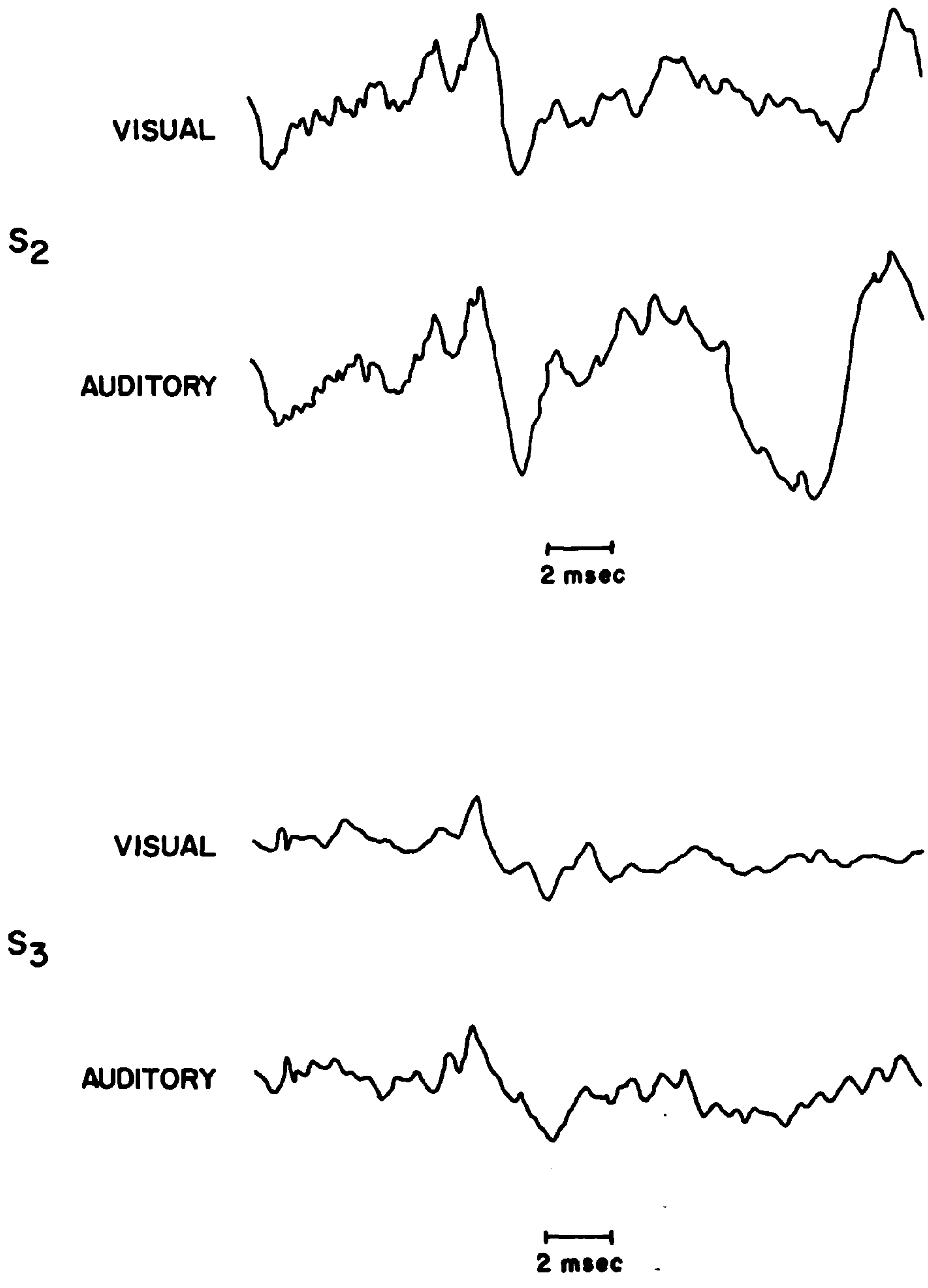
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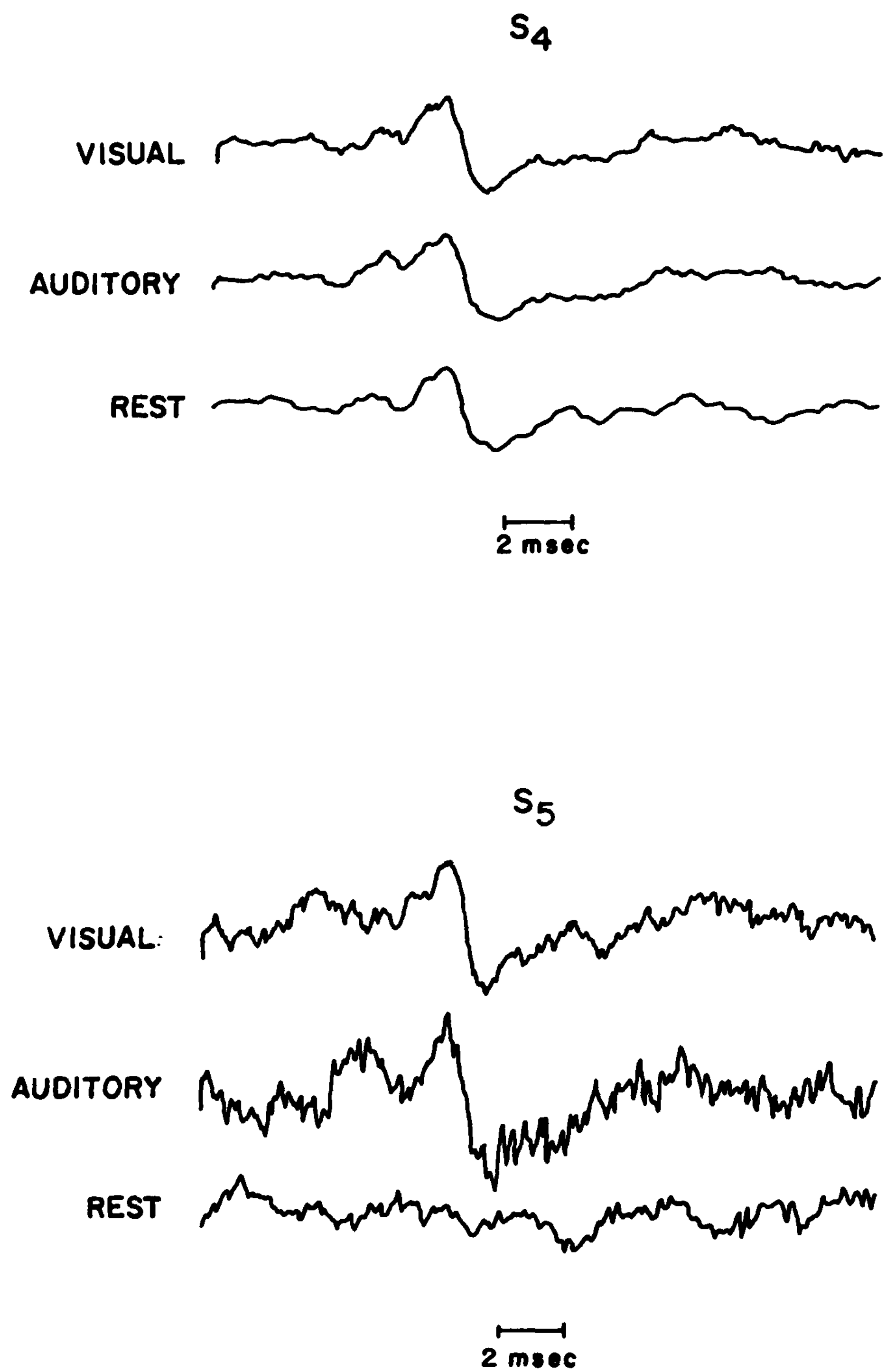
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